Infiltration/Inflow (I/I) Reduction Projects

King County, Washington

E & P Subcommittee Meeting

April 16, 2008

Purpose & Direction/Input

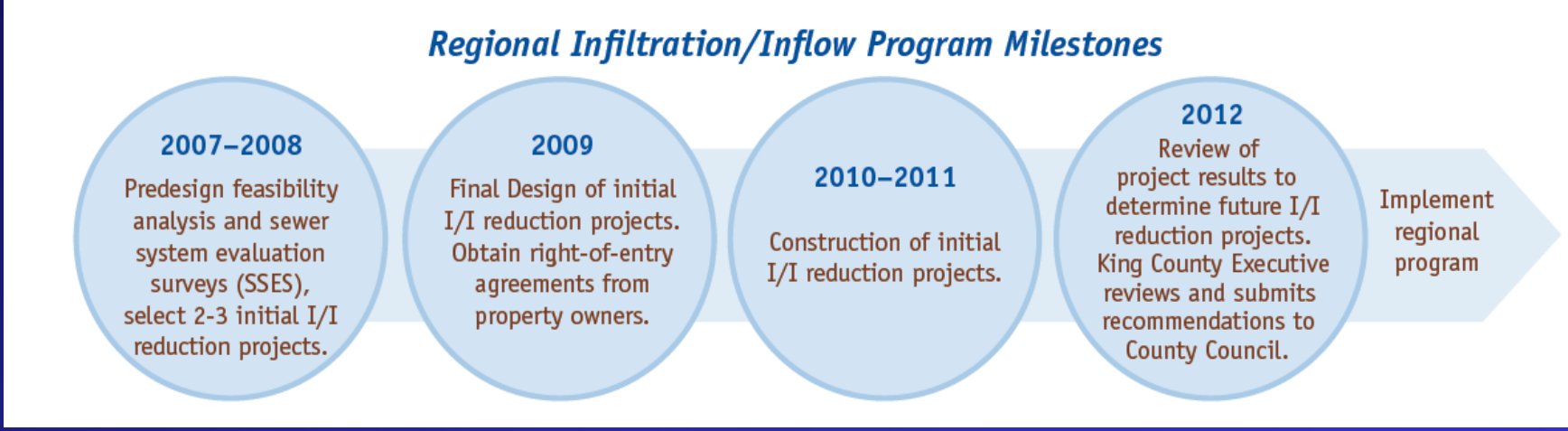
Meeting Purpose

- Inform the E & P Subcommittee about the status of I/I Reduction Efforts
  - Background information on I/I Program
  - Recent project revisions
  - Benefit/Cost Analysis Process
  - Specific Project Information
- Respond to questions
- Obtain input and direction from the E & P Subcommittee

E & P Subcommittee Needed Input and Direction

- Confirm Benefit/Cost Process and Approach
- Provide direction and input on potential approaches for specific projects

Project Timeline



Purpose of Initial I/I Projects

- To Demonstrate & Test the Cost-Effectiveness of I/I Removal on Large Scale
- To Test Planning Assumptions for Use in Future I/I Reduction Planning
- To Learn More from Working on Private Property
- To Provide Models for Successful Future Projects
- To Test Standards, Policies & Procedures

Benefit/Cost Criteria To Evaluate Cost Effectiveness

Benefits

- Reduced, Delayed, or Eliminated Capital Cost Savings for Regional Conveyance and Treatment Systems

Costs

- I/I project costs
  - Project Management
  - Engineering & Design
  - Construction
  - Mitigation

- Same criteria as originally developed for program

Benefit/Cost Ratio

- To evaluate cost effectiveness, a benefit/cost ratio was calculated for each initial project:

  Benefit/Cost Ratio =

  $$\frac{\text{(CSI Project Cost Savings After I/I Reduction)}}{\text{(Cost of Proposed I/I Reduction Project)}}$$

Example:

Original CSI Project Cost:	$10 million
Revised CSI Project Cost Based on Reduction:	$ 6 million
Savings to CSI Project (Benefit):	$ 4 million
Cost to Perform I/I Reduction (Cost):	$ 3 million

Benefit/Cost Ratio = $\frac{\$4 \text{ million}}{\$3 \text{ million}} = 1.33$

Summary of the Four Initial I/I Project Candidates

Project (Facility)	Local Agency	Exceedence Year	I/I Avail. (mgd)	Required I/I Reduction (mgd)	Benefit: CSI Cost Reduction	Cost: I/I Rehab	B/C Ratio	No. Private Prop.
South Renton Interceptor	Renton	2027	7.0	0.81	$7,270,000	$2,217,645	3.3	119
Issaquah Storage and Trunk	Issaquah	2022	5.4	1.05	$5,770,000	$3,964,850	1.5	395
Bryn Mawr Storage	Skyway	2008	16.2	2.04	$8,510,000	$6,018,534	1.4	557
Eastgate Storage and Trunk	Bellevue	2000	8.7	3.55	$16,629,000	$14,459,862	1.2	1,163

Recent Project Revisions

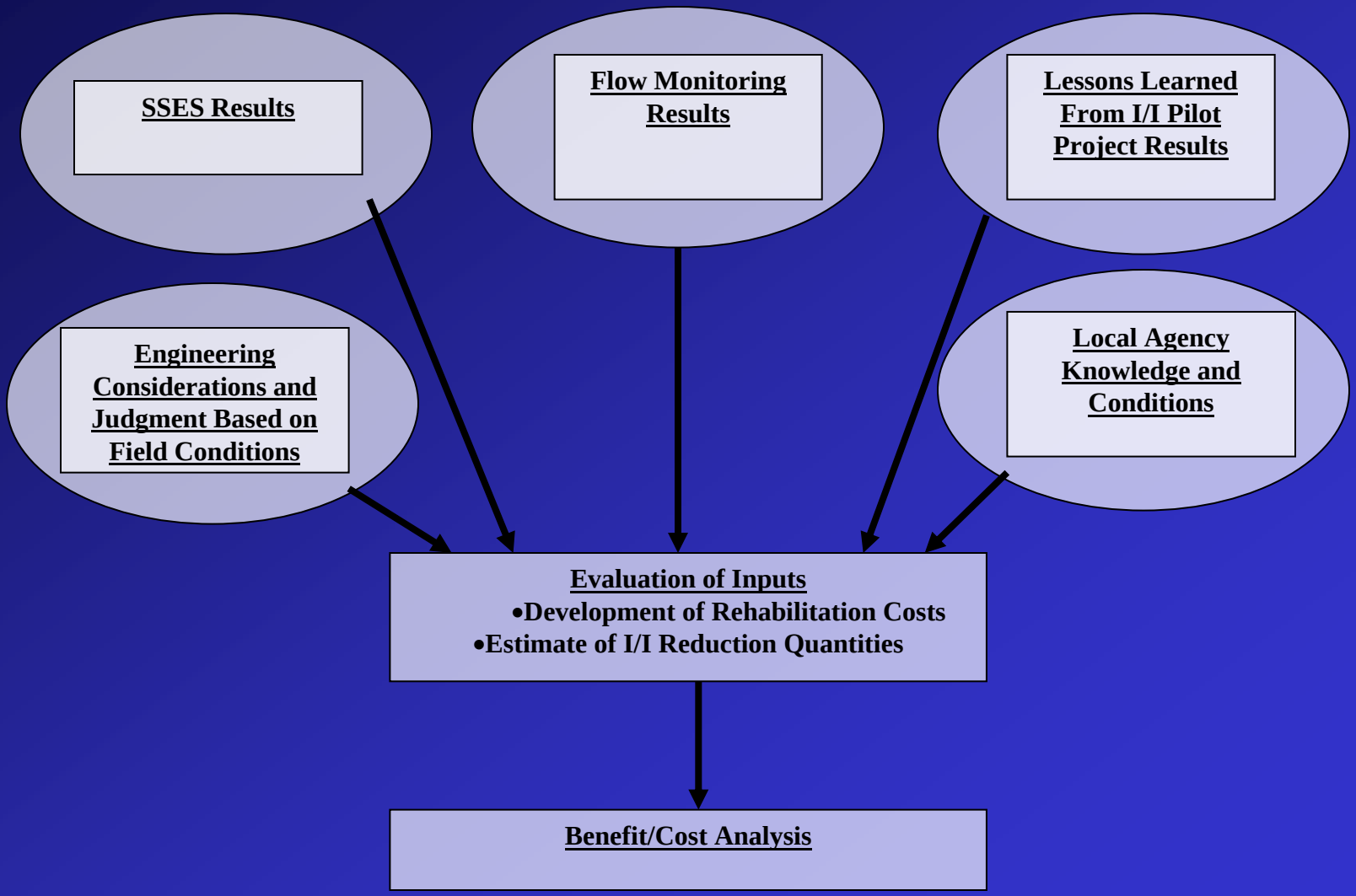
- County Budget Revisions Require a Reduction in Project Construction Costs from $15 Million to $8.5 Million
- Budget Reductions Accommodated in Predesign Approach by Evaluating Rehabilitation in Subsets of Available Basins
- Revisions to Specific Project Requirements, Timing and Capital Costs for Bryn Mawr Tube Storage

Revisions to Bryn Mawr Storage Requirements

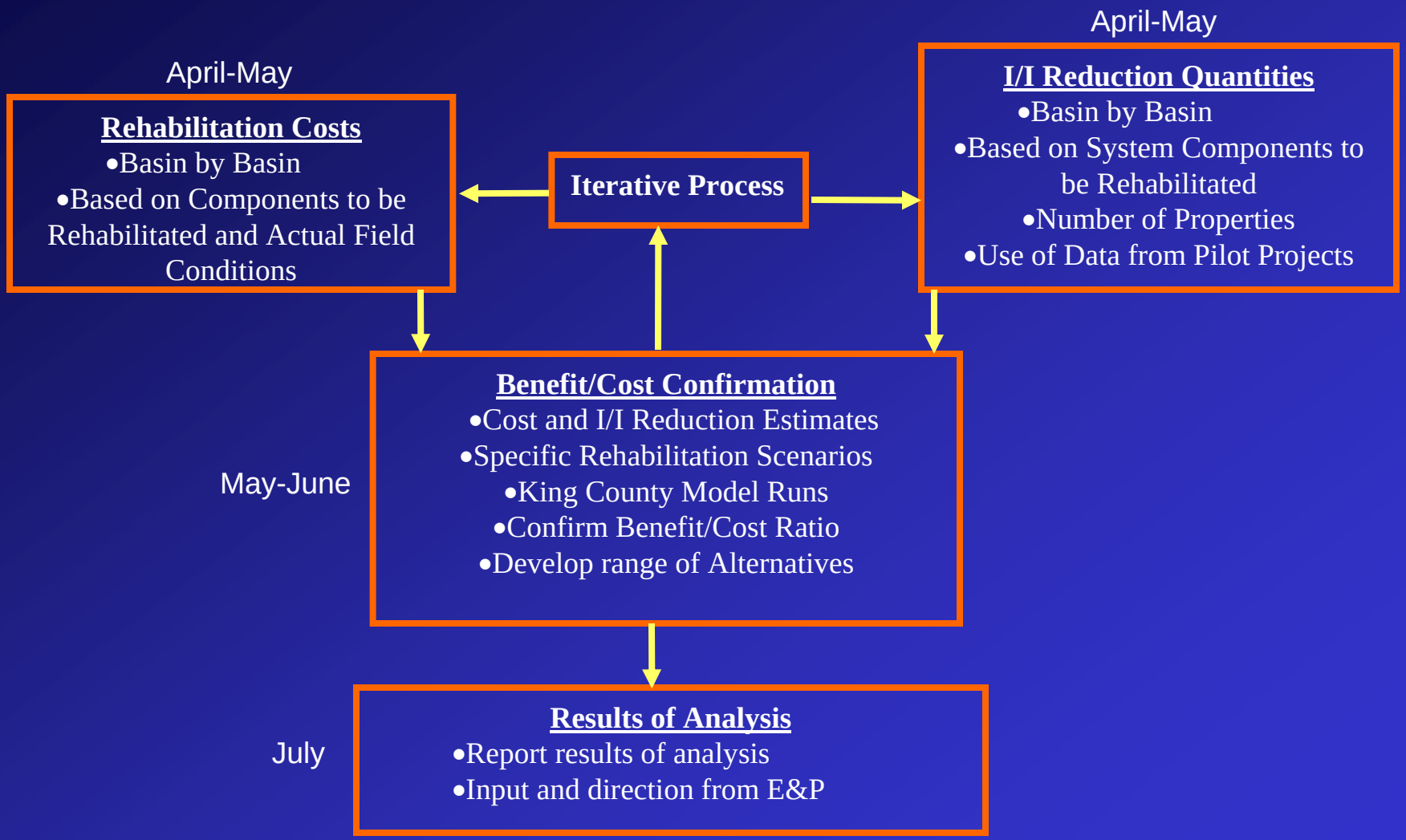
Project (Facility)	Local Agency	Exceedence Year	I/I Avail. (mgd)	Required I/I Reduction (mgd)	Benefit: CSI Cost Reduction	Cost: I/I Rehab	B/C Ratio	No. Private Prop.
South Renton Interceptor	Renton	2027	7.0	0.81	$7,270,000	$2,217,645	3.3	119
Issaquah Storage and Trunk	Issaquah	2022	5.4	1.05	$5,770,000	$3,964,850	1.5	395
Bryn Mawr Storage[1]	Skyway	2008 ***2022***	16.2	2.04 ***1.63***	$8,510,000 ***$3,680,000***	$6,018,534 ***???***	1.4 ***???***	557
Eastgate Storage and Trunk	Bellevue	2000	8.7	3.55	$16,629,000	$14,459,862	1.2	1,163

1. Storage requirement revised from 320,000 gallons to 78,000 gallons

Factors Considered in I/I Project Alternatives Development



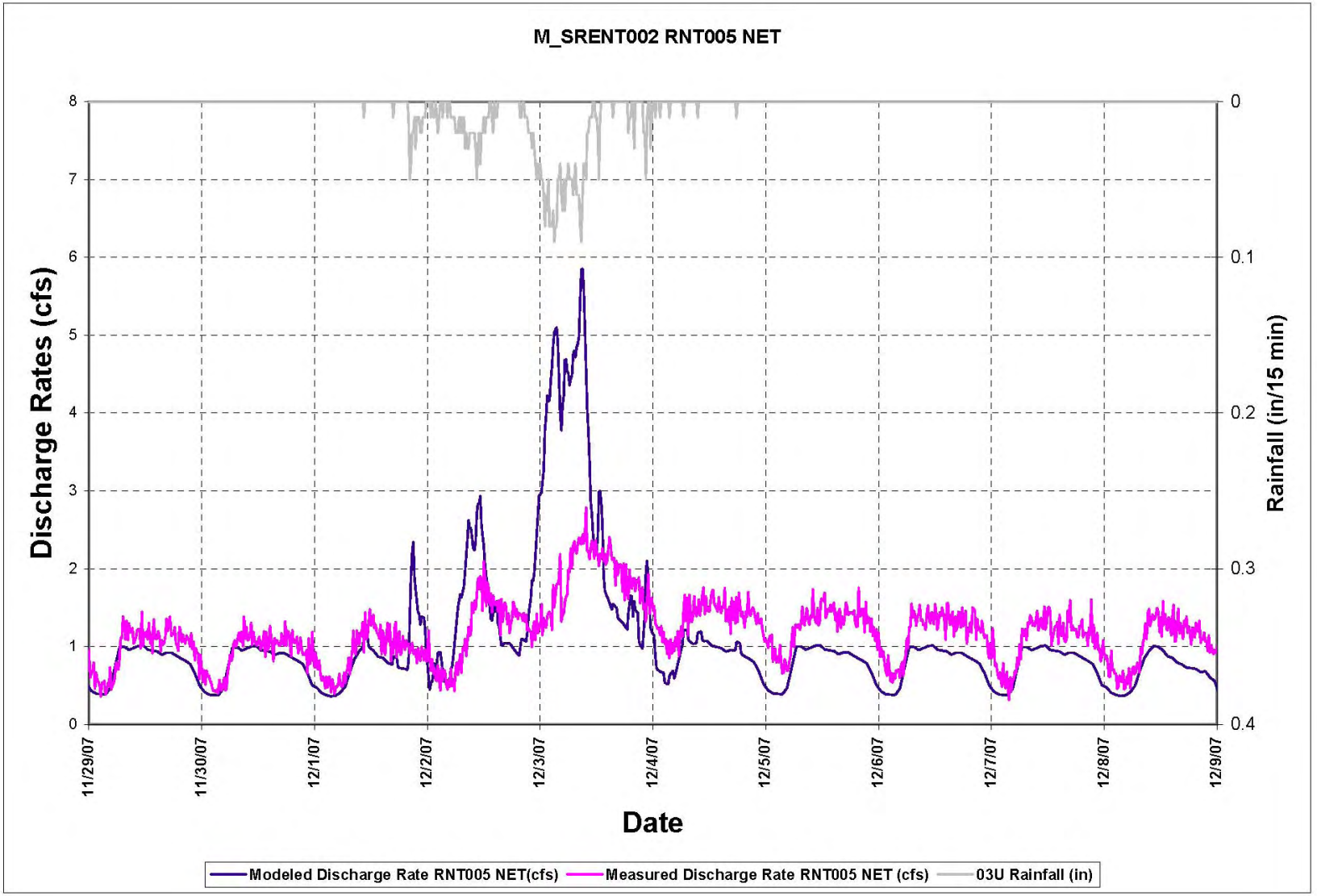
Project Alternatives Process



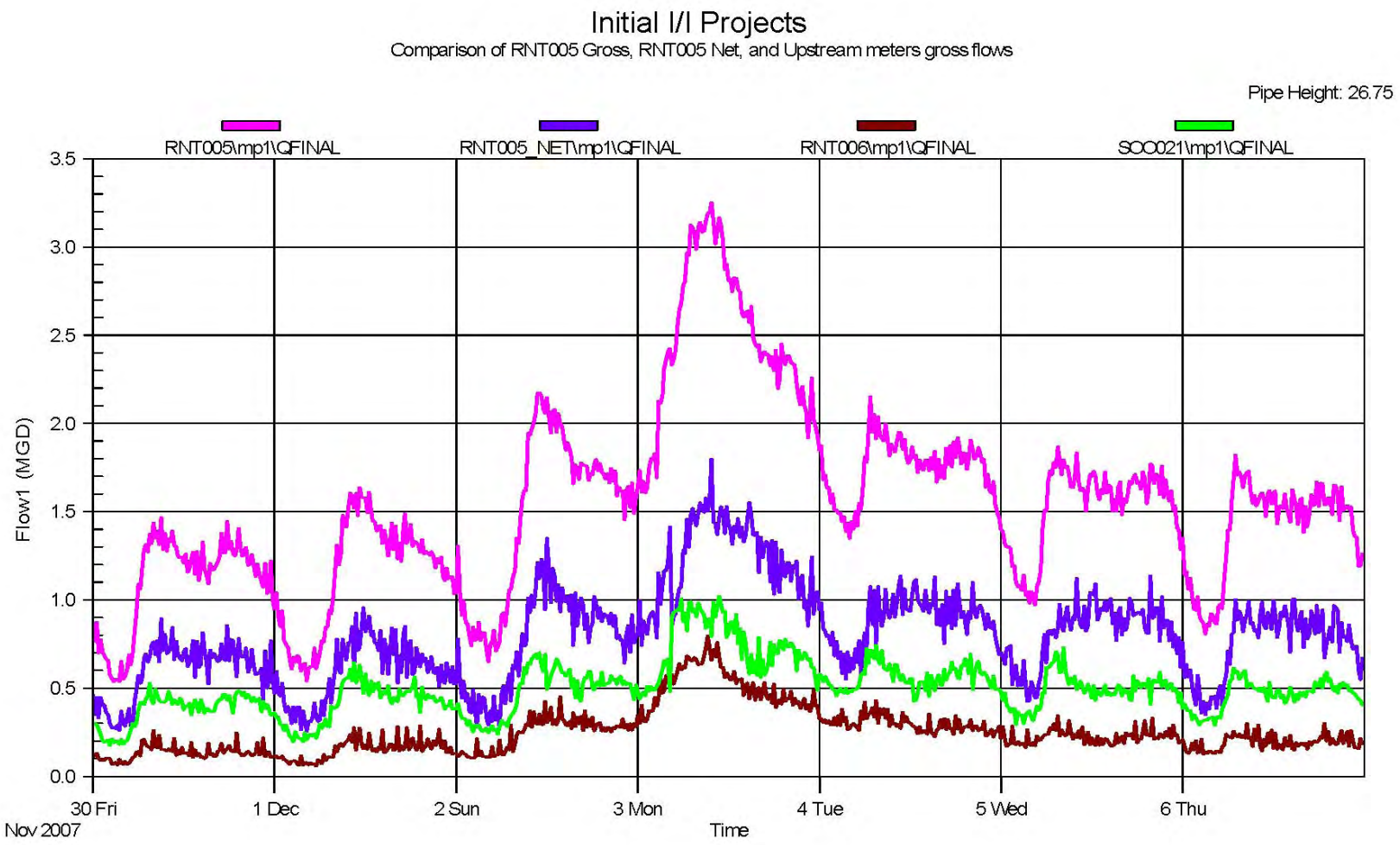
Renton Project Area Summary

- Suspicion of “Smoking Gun” Problem in Basin
- Summary of SSES Results
  - Few Smoke Testing Hits in Basin
  - No Hospital Direct Connects Revealed by Dye Testing
  - CCTV Investigation Focused on Downstream Portion of Basin
  - Some Infiltration Sources Revealed in Mains and Manholes
- Recent Flow Monitoring Results

Net RNT005 Modeled Vs. Measured Flows



Total RNT005 Measured Flows



Renton Project Area Summary

- Field Observations During December 2007 Storm
  - 7 Manholes in Wetland Area Parallel to SR-167 Subject to Inflow and Infiltration
  - All 7 Manholes Show Signs of Infiltration (Based on Visual and CCTV Inspection)
  - 6 Manholes Showed Signs of up to 2 Feet of Inundation by Surface Waters

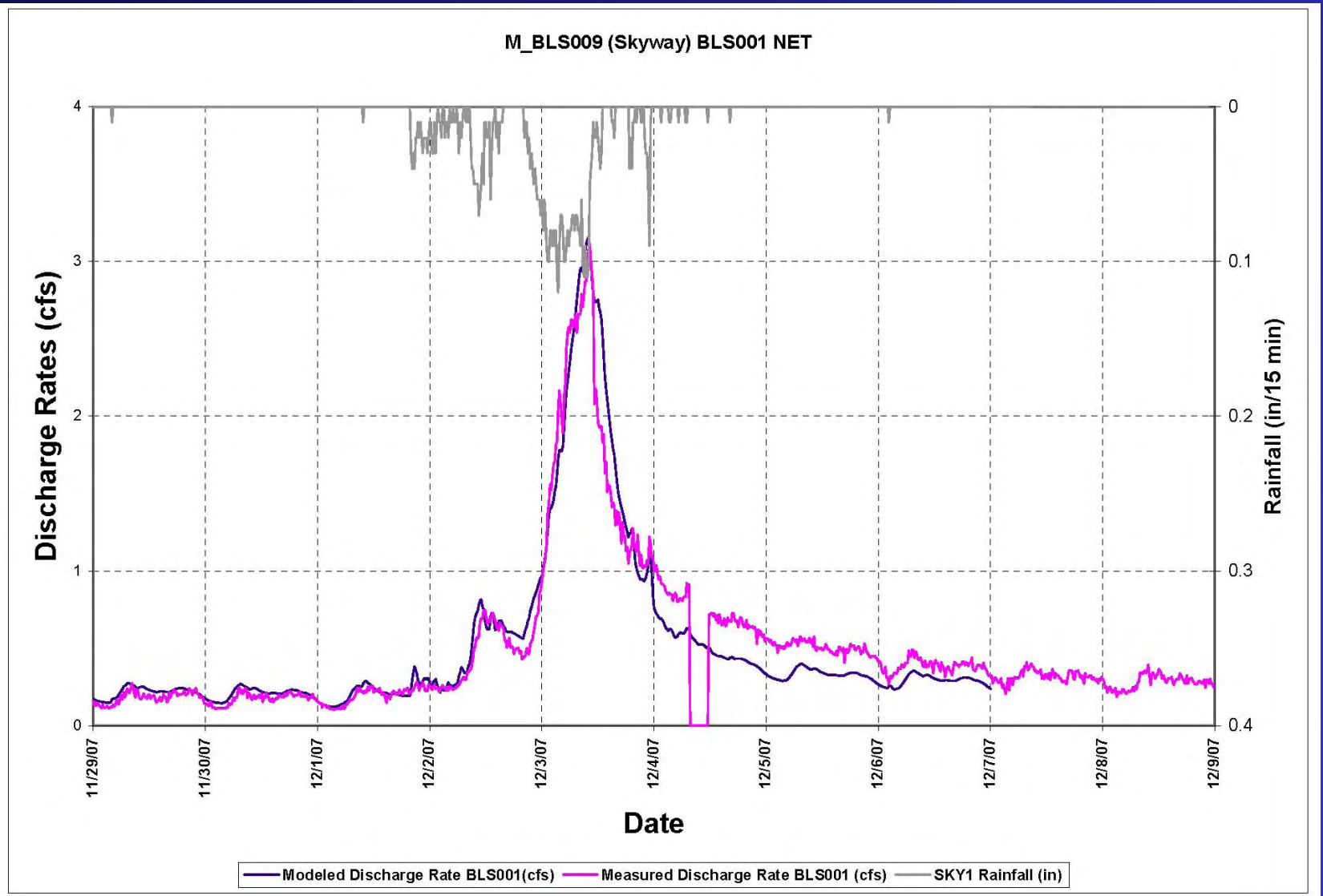
Renton Project Area Summary

- Potential Approach for Renton Basin
  - Implement Immediate Repairs to Correct Identified Deficiencies
  - Grout and Line 7 Manholes
  - Raise 6 Manholes
  - Line Approximately 250 Lineal Feet of Sewer Main In Wetland Area
  - Corrective Actions Implemented By City of Renton at an Approximate Cost of $50k - $60k Funded Through I/I Program
  - County to Provide Continued Flow Monitoring During Subsequent Wet Seasons
  - No Additional Investigation of Basin to Identify and Correct Other I/I Sources

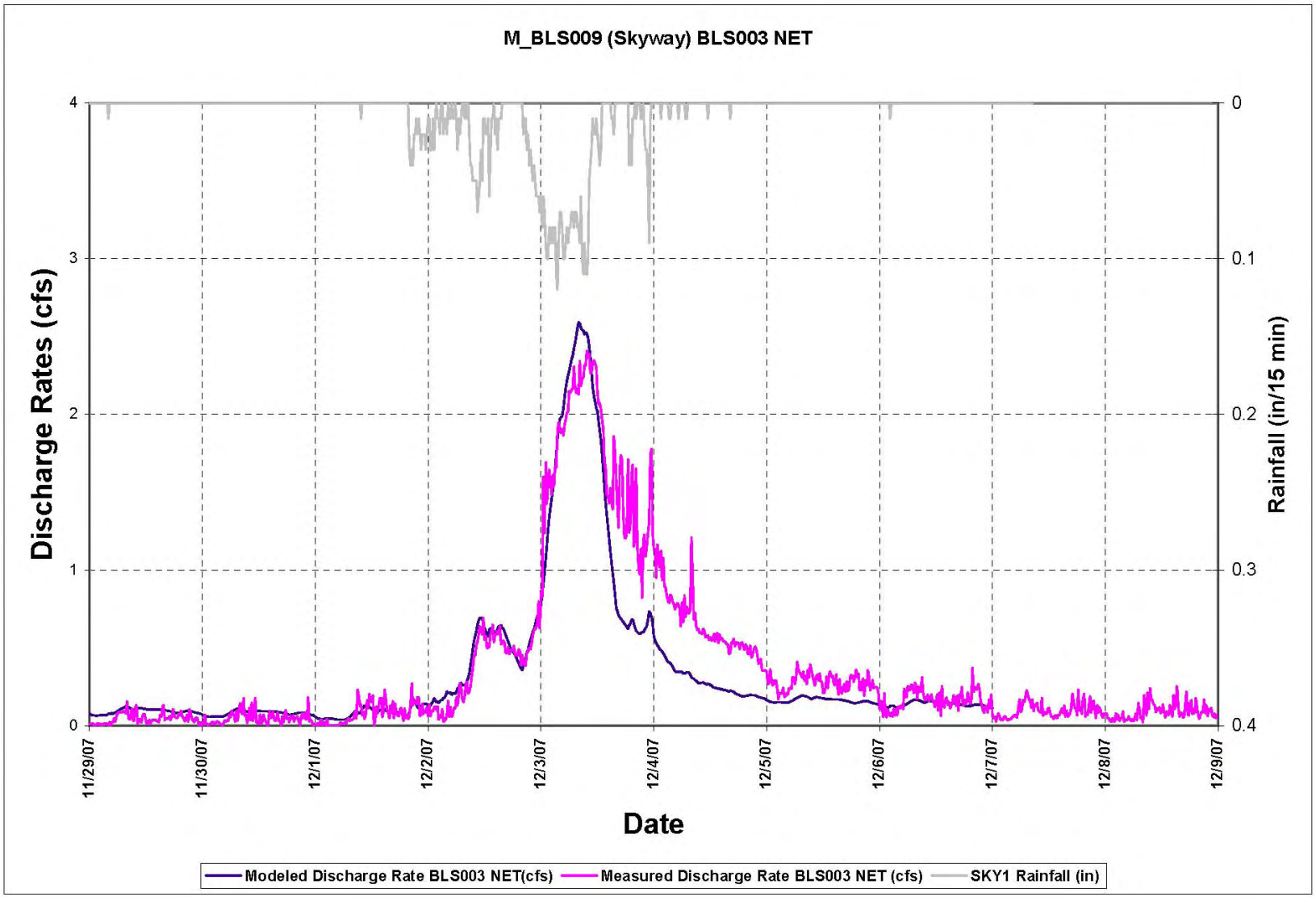
Skyway Project Area Summary

- Summary of SSES Results in BLS001 and BLS003
  - 47 Smoke Testing Hits in Basins
  - CCTV Revealed Moderate Number of Defects in Mains, Laterals and Side Sewers
  - Lateral and Side Sewer Materials and Methods of Construction Suggest Potential I/I Sources
  - Results are Consistent with SSES Work Completed During Pilot Project
- Recent Flow Monitoring Results

BLS001 Modeled Vs. Measured Flows



BLS003 Modeled Vs. Measured Flows

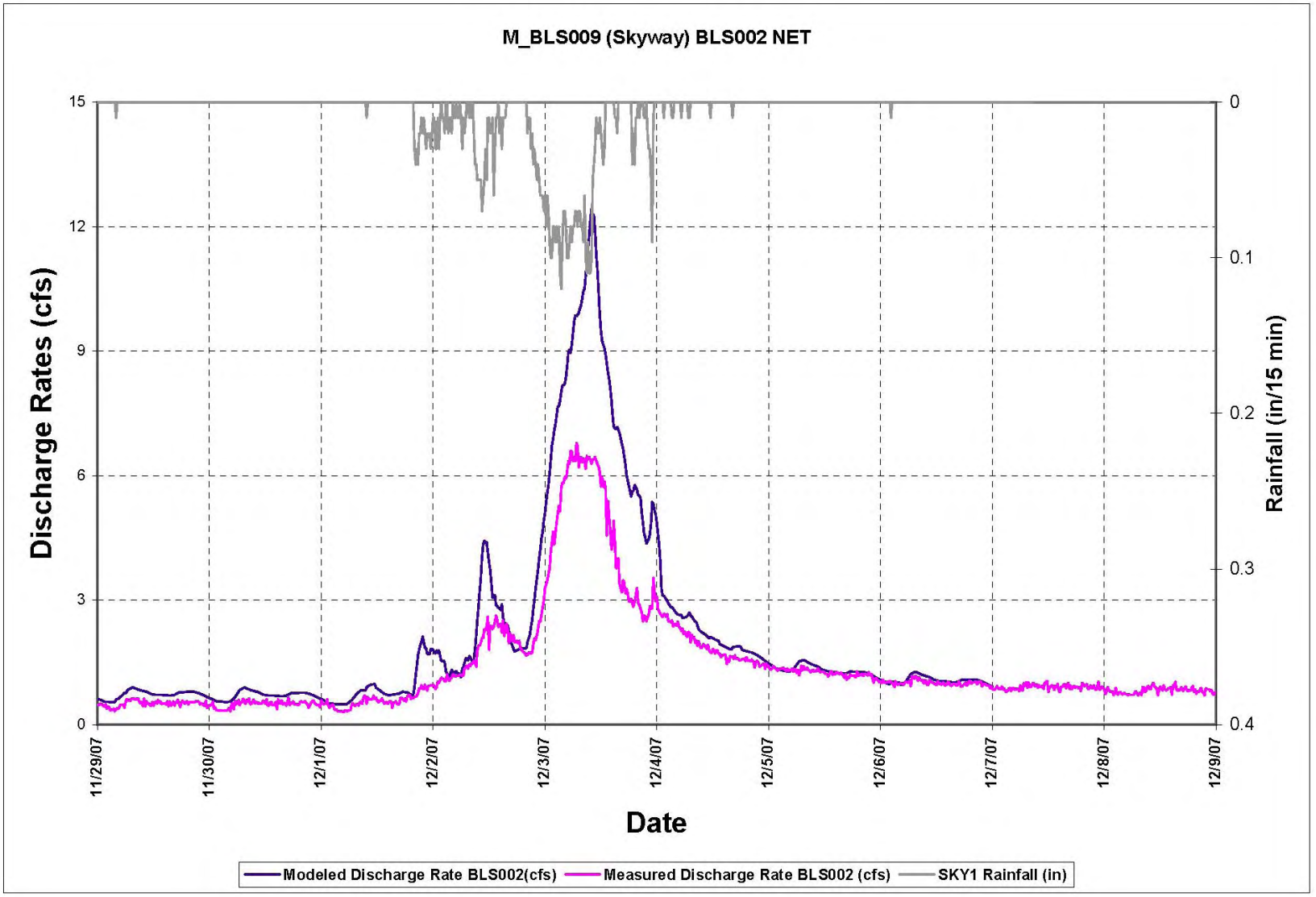


Skyway Project Area Summary

- Rehabilitation in BLS001 and BLS003 More Complicated and Costly Than Pilot
  - Mains Through Backyards
  - Over 500 Properties in the Two Basins (Compared With 163 Rehabilitated in Pilot)
  - Lower I/I Available in the Two Basins (2.04 MGD Vs. 2.5 MGD Reduction Attained in Pilot)
- Flow Monitoring Indicates High I/I Totals Remain in BLS002

BLS002 Basin

BLS002 Modeled Vs. Measured Flows



Skyway Project Area Summary

- Windshield Survey of BLS002 Performed
- Remaining Un-Rehabilitated Portions of Basin Very Similar to Pilot
- Lateral and Side Sewer Rehabilitation Can Be Achieved at Less Cost With Higher I/I Removal per Property in BLS002 vs. BLS001 and BLS003

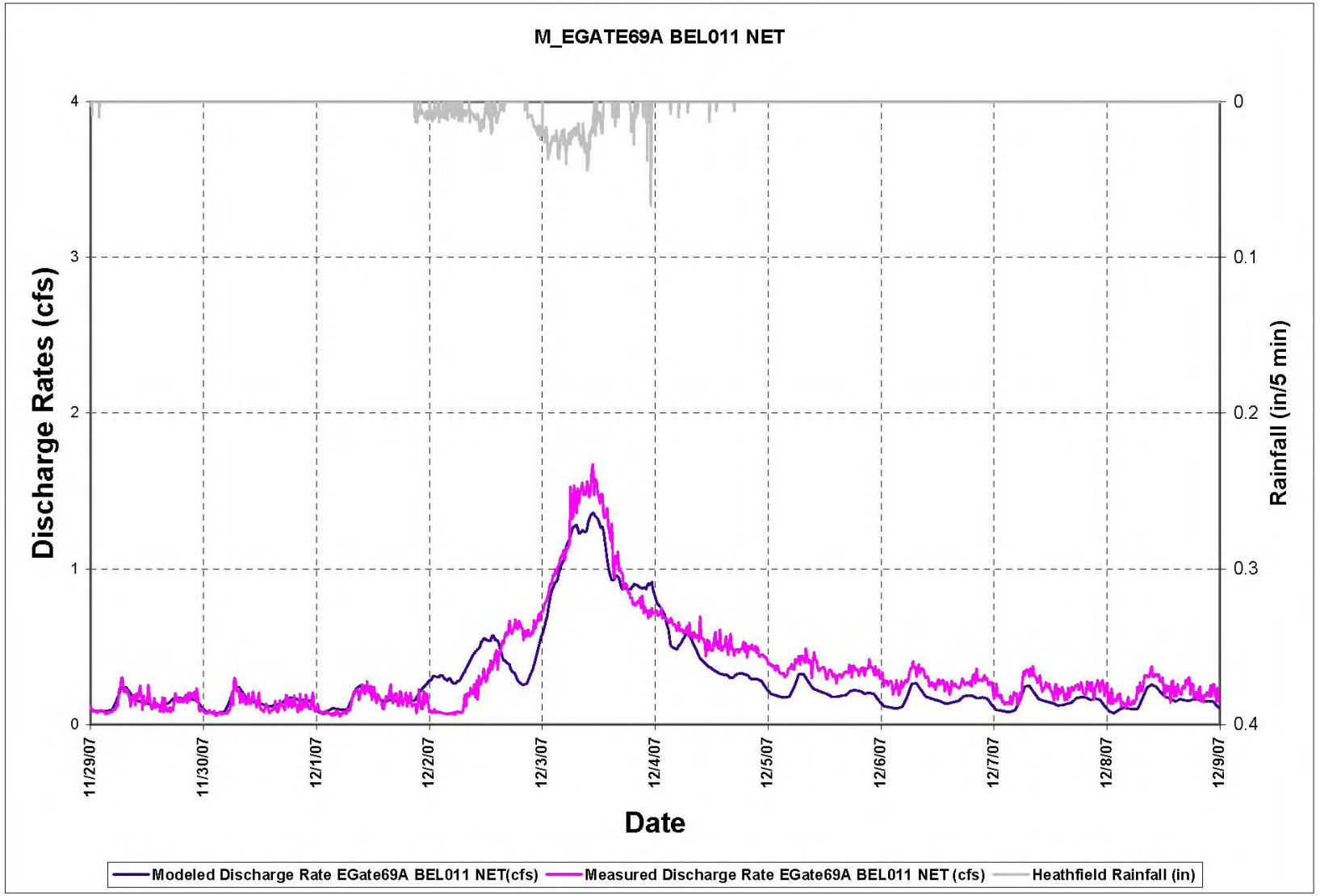
Skyway Project Area Summary

- Approach for Skyway Project Area
  - Continue Evaluating Skyway Project Area Considering Revised Regional Conveyance System Requirements
  - Include BLS002 in Predesign Evaluation of Skyway Project Area
  - Perform Smoke Testing in BLS002 and CCTV Approximately 10% of Mains, Laterals and Side Sewers To Assess Condition and Materials of Construction

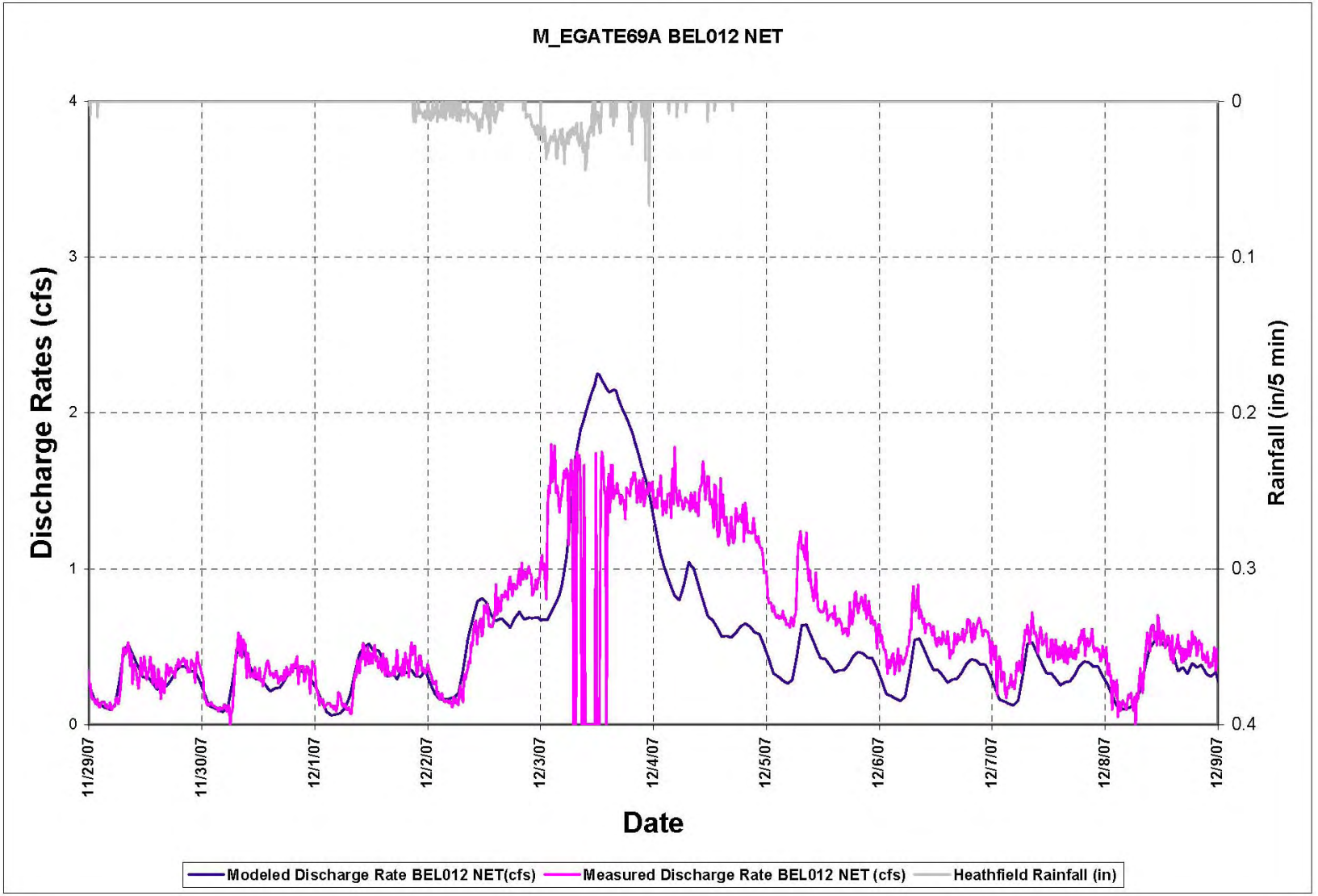
Eastgate Project Area Summary

- Summary of SSES Results
  - 30 Smoke Testing Hits in Basins
  - CCTV Revealed Moderate Number of Defects in Mains, Laterals and Side Sewers
  - Sewer Mains Appear in Good Condition
  - Lateral and Side Sewer Materials and Methods of Construction Suggest Potential I/I Sources
- Recent Flow Monitoring Results

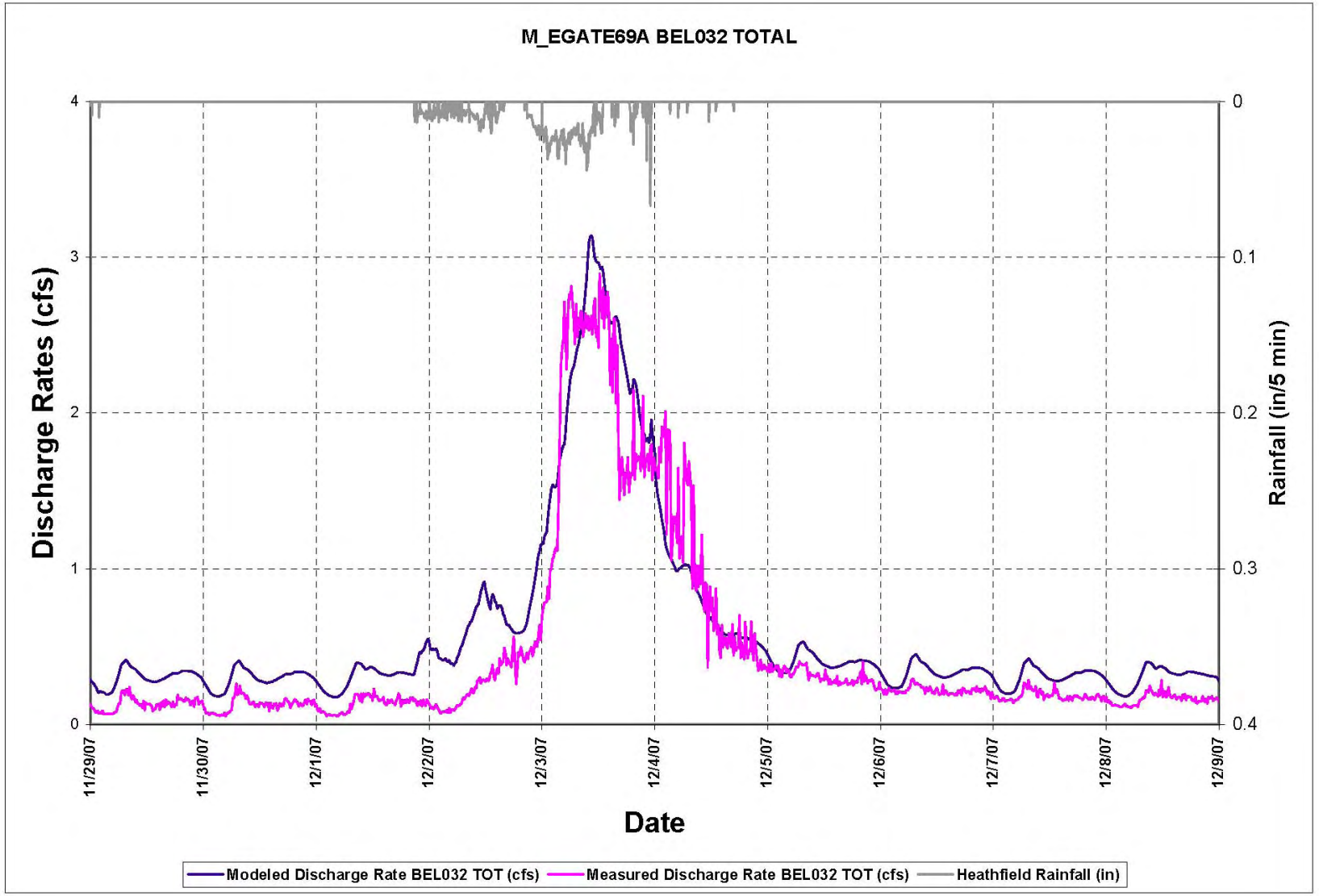
BEL011 Modeled Vs. Measured Flows



BEL012 Modeled Vs. Measured Flows



BEL031 & BEL032 Modeled Vs. Measured Flows



Eastgate Project Area Summary

- BEL014 Least Attractive of Basins for Rehabilitation of Mains, Laterals and Side Sewers
  - Newer Development Than Other Eastgate Basins
  - More PVC Mains, Laterals and Side Sewers
  - High Number of Difficult Access Properties
  - Moderate I/I Totals in Basin
  - I/I Reduction by Disconnection of Inflow Sources Remains Viable in Basin

Eastgate Project Area Summary

- In General, All Eastgate Basins Present Difficult Rehabilitation Challenges
  - Nearly Half of Mains Are Located in Backyards
  - Many Areas with Difficult Access Constraints
  - Challenges Will Result in Higher Rehabilitation Costs

Eastgate Field Conditions
Easy Rehabilitation

- Low to Moderate Relief
- Direct Side Sewer Routing
- Easy Access to Main and Building Point of Connection
- Typical Restoration

Eastgate Field Conditions
Medium Rehabilitation

- Moderate to Steep Relief
- Likelihood of Multiple Bends
- Challenging Access to Building Point of Connection
- Medium Value Restoration

Eastgate Field Conditions Difficult Rehabilitation

- Steep to Extreme Relief
- Shared Side Sewers w/ Multiple Bends
- Challenging Access Building Point of Connection
- Constructed Access to Main Point of Connection
- High Value Restoration and Larger Disturbance Areas

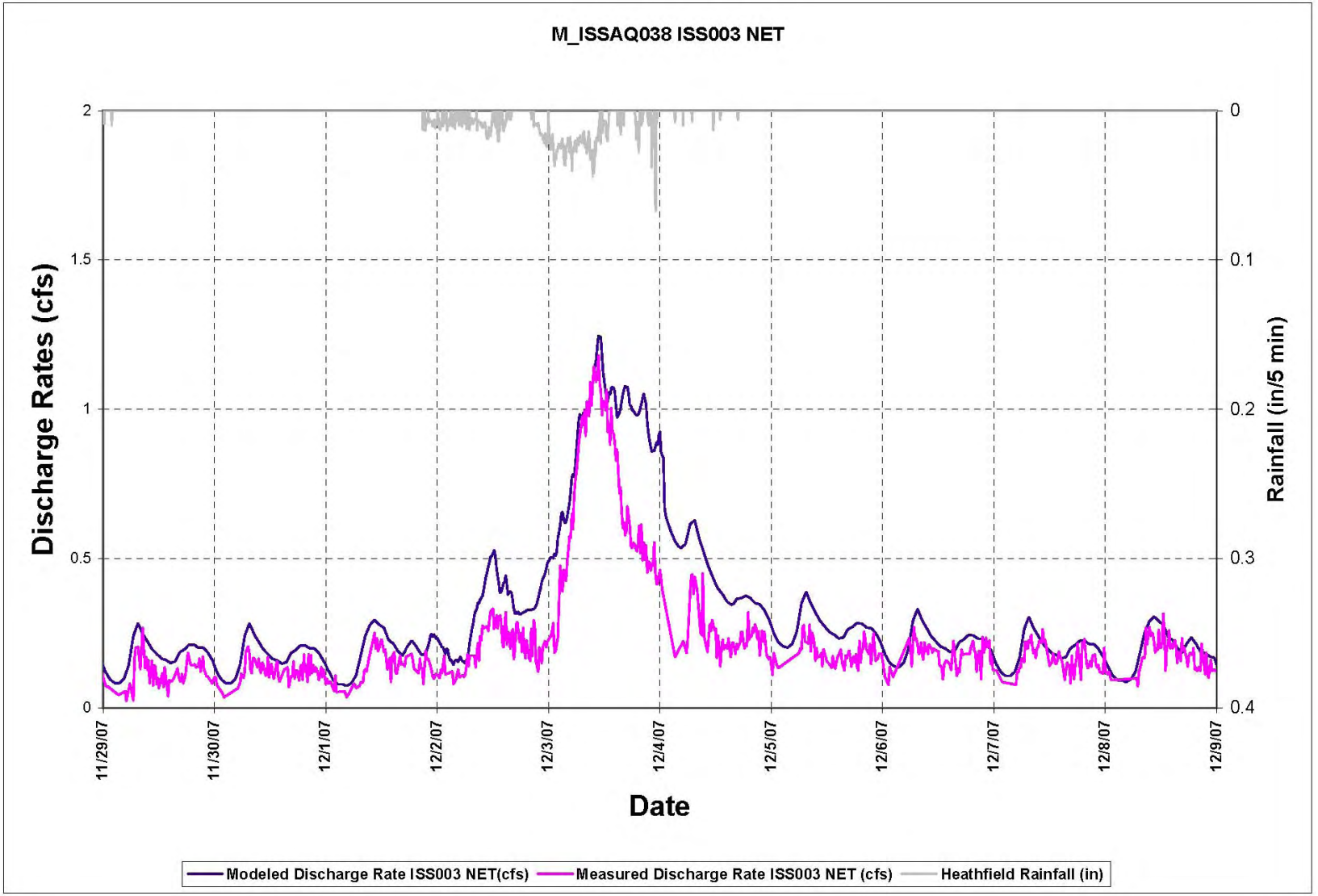
Eastgate Project Area Summary

- Approach for Eastgate Project Area
  - Remove BEL014 From Further Analysis and Consideration for Main, Lateral and Side Sewer Rehabilitation
  - Continue Evaluation of Disconnecting Inflow Sources in Basin BEL014
  - Continue Evaluating BEL011, BEL012, BEL031 and BEL032 Recognizing Higher Construction Costs Are Likely
  - Rehabilitation Alternatives Likely Limited to One or Two of the Four Basins Due to Reduced Project Budget

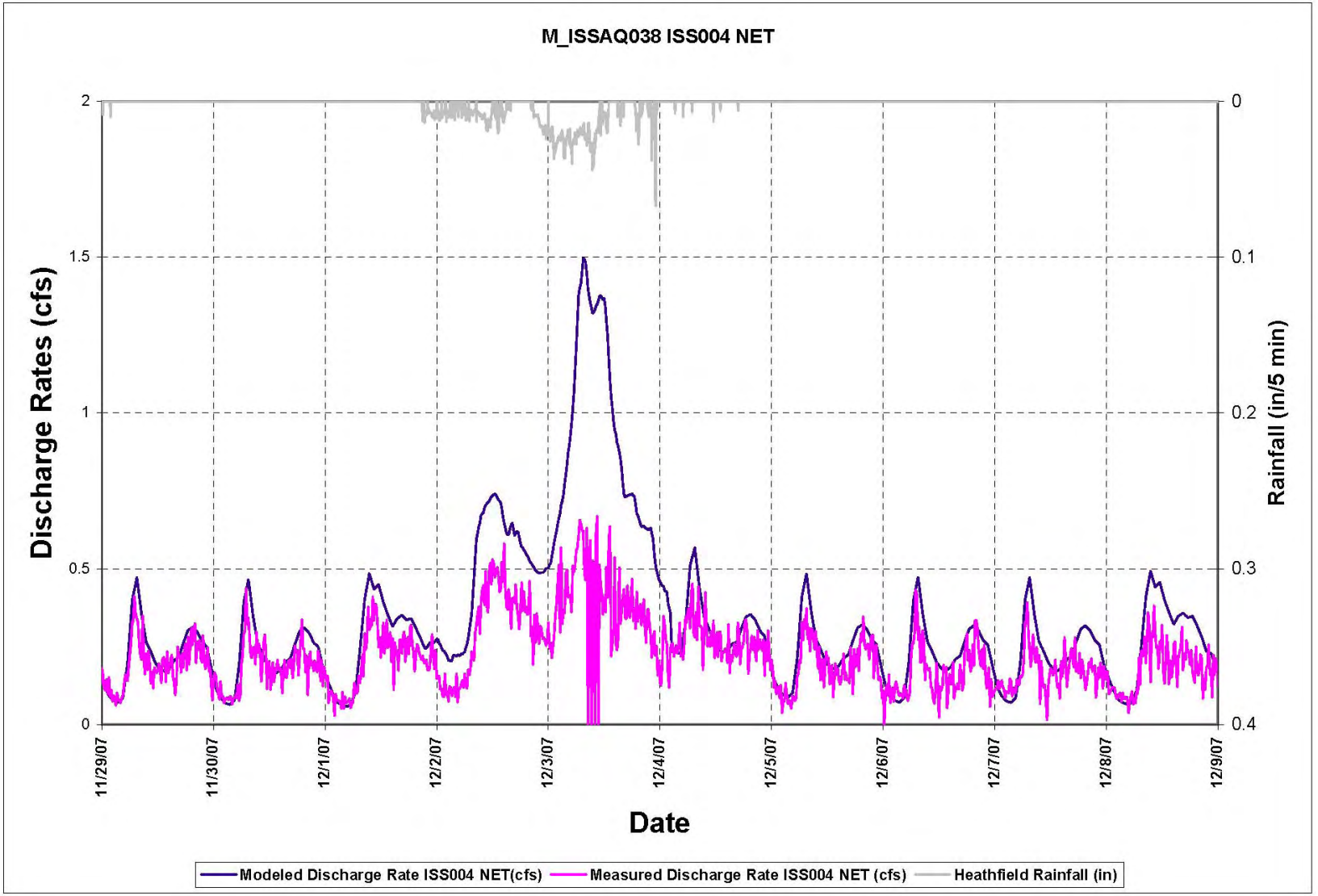
Issaquah Project Area Summary

- Summary of SSES Results
  - 7 Smoke Testing Hits in Basins
  - CCTV Being Completed; Not Yet Reviewed
- Issaquah Basins Exhibit Similar Challenges as Eastgate Area
- Recent Flow Monitoring Results

ISS003 Modeled Vs. Measured Flows



ISS004 Modeled Vs. Measured Flows



Issaquah Project Area Summary

- Approach for Issaquah Project Area
  - Continue Evaluating ISS003 and ISS004 Recognizing Higher Construction Costs Are Likely
  - Eastgate and Issaquah Areas Evaluated Concurrently
  - Rehabilitation Alternatives May Include Work in One of the Two Issaquah Basins and May Be Combined with Eastgate Rehabilitation

E&P Subcommittee Direction and Input

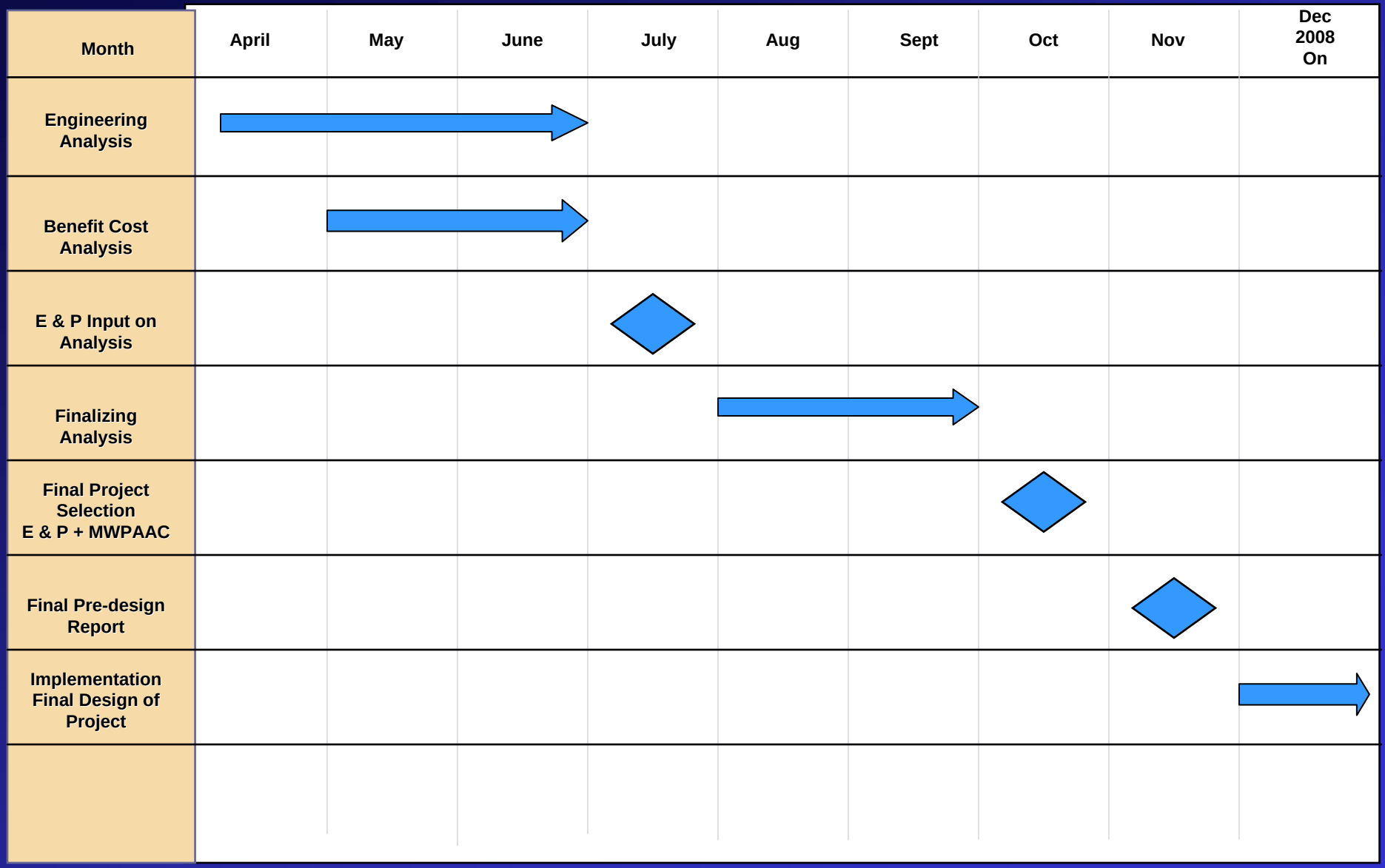
1. Does the E & P Subcommittee have comments or questions regarding the presented Benefit/Cost approach?

2. Does the E & P Subcommittee agree with the potential approach for the Renton project area?

3. Does the E & P Subcommittee agree with the approach outlined for the Skyway project area and agree with including BLS002 in the evaluation?

4. Does the E & P Subcommittee agree with the approach outlined for the Eastgate and Issaquah project areas including reduced evaluation of BLS014?

Next Steps


Month
April
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Dec 2008 On
Engineering Analysis
Benefit Cost Analysis
E & P Input on Analysis
Finalizing Analysis
Final Project Selection E & P + MWPAAC
Final Pre-design Report
Implementation Final Design of Project

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